

**K.L.N. COLLEGE OF INFORMATION TECHNOLOGY**  
**POTTAPALAYAM, SIVAGANGAI -630612**

**ANNA UNIVERSITY CHENNAI –SYLLABUS REGULATION 2017**

**CY8151 ENGINEERING CHEMISTRY**

**L T P C**

**OBJECTIVES**

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- ❖ To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- ❖ To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- ❖ Preparation, properties and applications of engineering materials.
- ❖ Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- ❖ Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

**UNIT I WATER AND ITS TREATMENT 9** Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS 9** Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement. Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE 9** Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION 9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES 9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries

– primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS**

### **OUTCOMES**

The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

### **TEXT BOOKS**

1. S. S. Dara and S. S. Umare, —A Textbook of Engineering Chemistry||, S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, —Engineering Chemistry|| Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, —Engineering Chemistry||, Wiley India PVT, LTD, New Delhi, 2013.

### **REFERENCES**

- 1 Friedrich Emich, —Engineering Chemistry||, Scientific International PVT, LTD, New Delhi, 2014.
- 2 Prasanta Rath, —Engineering Chemistry||, Cengage Learning India PVT, LTD, Delhi, 2015.
- 3 Shikha Agarwal, —Engineering Chemistry-Fundamentals and Applications||, Cambridge University Press, Delhi, 2015.

**OBJECTIVES**

- ❖ To study the nature and facts about environment.
- ❖ To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- ❖ To study the interrelationship between living organism and environment.
- ❖ To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- ❖ To study the dynamic processes and understand the features of the earth's interior and surface.
- ❖ To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural. 24

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **OUTCOMES**

- ❖ Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- ❖ Public awareness of environmental is at infant stage.
- ❖ Ignorance and incomplete knowledge has lead to misconceptions
- ❖ Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXTBOOKS**

- 1 Benny Joseph, ‘\_Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi, 2006.
- 2 Gilbert M.Masters, ‘\_Introduction to Environmental Engineering and Science’, 2nd edition, Pearson Education, 2004.

#### **REFERENCES**

- 1 Dharmendra S. Sengar, ‘\_Environmental law’, Prentice hall of India PVT LTD, New Delhi, 2007.
- 2 Erach Bharucha, —Textbook of Environmental Studies||, Universities Press(I) PVT, LTD, Hyderabad, 2015.
- 3 Rajagopalan, R, ‘\_Environmental Studies-From Crisis to Cure’, Oxford University Press, 2005.
- 4 G. Tyler Miller and Scott E. Spoolman, —Environmental Science||, Cengage Learning India PVT, LTD, Delhi, 2014.

## **CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

### **OBJECTIVES**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.

### **LIST OF EXPERIMENTS**

- 1 Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
- 2 Determination of total, temporary & permanent hardness of water by EDTA method.
- 3 Determination of DO content of water sample by Winkler's method.
- 4 Determination of chloride content of water sample by argentometric method.
- 5 Estimation of copper content of the given solution by Iodometry.
- 6 Determination of strength of given hydrochloric acid using pH meter.
- 7 Determination of strength of acids in a mixture of acids using conductivity meter.
- 8 Estimation of iron content of the given solution using potentiometer.
- 9 Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
- 10 Estimation of sodium and potassium present in water using flame photometer.
- 11 Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
- 12 Pseudo first order kinetics-ester hydrolysis.
- 13 Corrosion experiment-weight loss method.
- 14 Determination of CMC.
- 15 Phase change in a solid.
- 16 Conductometric titration of strong acid vs strong base.

### **OUTCOMES**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

**TEXTBOOKS :** 1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014).